

# DESCRIPTIONS OF THREE NEW SPIDERS OF THE *PARDOSA LAURA* COMPLEX (ARANEAE: LYCOSIDAE) BASED ON THEIR MORPHOLOGY AND ECOLOGY

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## Synopsis

TANAKA, Hozumi (Konko Daiichi Senior High School, Higashi-kammaki, Takatsuki City, Osaka Pref., 569 Japan) and SUWA, Masayoshi (Institute of Applied Zoology, Faculty of Agriculture, Hokkaido University, Sapporo, 060 Japan): Descriptions of three new spiders of the *Pardosa laura* complex (Araneae: Lycosidae) based on their morphology and ecology. *Acta arachnol.*, 34: 49-60 (1986).

Based on morphological and behavioral differences, three new species, *Pardosa hokkaido*, *P. yamanoi*, and *P. laevitarsis* which are allied to *Pardosa laura* are described.

## Introduction

TANAKA (1976) indicated that some different groups were seen in spiders which were identified with *Pardosa laura*, and divided them morphologically in three forms (Forms I, II, and III). Afterward, SUWA (1980) observed the patterns of these courtship behaviors and he (1982) suggested that Form III consisted of two forms (Forms III and IV). After Forms I, II, and III were reported, SUWA (1984) described Form IV and two new forms (Forms Iki and Nansei) in *P. laura*, based on differences of the arrangement of white pubescence on palpi and the courtship behavior of males. From the view points of taxonomy and ecology, TANAKA (1985) proposed that those three forms (Forms I, II, and IV) should be

treated each as independent species. In this paper, moreover, we describe three forms (Forms III, Iki, and Nansei) as three new species, *Pardosa hokkaido*, *P. yamanoi*, and *P. laevitarsis*.

The type specimens are deposited in the collection of the Arachnological Society of East Asia (Osaka, Japan).

**Acknowledgements** We wish to express our hearty thanks to Prof. T. YAGINUMA, Ohtemon Gakuin University, for his helpful advice and guidance, and for allowing us to examine his personal collection, and to Prof. H. MORI, Hokkaido University, for his continuous encouragement and guidance. Our thanks are also due to Messrs, T. YAMANO, H. YOSHIDA, and T. ENDO for their kindness in permitting us to use their precious collection and for valuable suggestions.

***Pardosa hokkaido* n. sp.**

(Japanese name: Kita-harige-komorigumo)

Male (Holotype)

Measurements (mm). Total length 4.95. Carapace length 2.70, width 2.05. Abdomen length 2.25, width 1.60.

Leg	Femur	Patella & Tibia	Metatarsus	Tarsus	Total
I	1.95	2.65	1.75	1.20	7.55
II	1.95	2.35	1.65	1.15	7.10
III	1.80	2.20	1.95	1.10	7.05
IV	2.40	2.85	2.90	1.55	9.70
Palp	1.00	1.05	—	1.00	3.05

Carapace blackish brown, with a yellowish brown median band, which is widened in front. AME larger than ALE; AME separated from each other by about the diameter of ALE, and from ALE by half the diameter of ALE; anterior eye row procurved. Clypeus yellowish brown, larger than the diameter of AME. Chelicerae reddish yellow, with light yellowish brown apex and with a black longitudinal band in venter; chelicera with three teeth on retromargin. Maxillae, labium and sternum greyish black. Abdomen reddish brown, with many black spots; a median mark indistinct; lateral and ventral sides dark reddish brown, with black markings. Coxae and trochanters I-IV black and the remaining segments I-IV yellowish brown; all the femora and tibiae with distinct annulations. Palpi blackish brown, with white pubescence on dorsal and lateral

sides of femur and patella; tarsal organs (Figs. 1-2) with a robust median apophysis; tarsus with two claws.

Allotype

Measurements (mm). Total length 8.00. Carapace length 3.00, width 2.35. Abdomen length 5.00, width 3.50.

Leg	Femur	Patella & Tibia	Metatarsus	Tarsus	Total
I	2.25	3.00	1.85	1.25	8.35
II	2.20	2.80	1.75	1.20	7.95
III	2.15	2.65	2.10	1.15	8.05
IV	2.90	3.50	3.35	1.70	11.45
Palp	1.10	1.25	—	1.00	3.35

Similar to the male holotype, but differs from it in the following characteristics: Carapace reddish brown with yellowish brown lateral bands and yellowish brown median band, which is broadened in front. Chelicerae yellowish brown. Maxillae greyish brown. Abdomen yellowish brown, with many black markings and spots; a median mark distinct. Legs and palpi yellowish brown, except for black markings on coxae I-IV; femora, tibiae and metatarsi of all legs, and femora, patellae and tibiae of palpi with distinct annulations. Epigynum with a pair of narrow genital openings, as shown in Fig. 3; spermathecae not extending to anterior edge of genital openings (Fig. 4).

Variation: Total length ♀ 4.90-7.75, ♂ 4.45-5.15. Carapace length ♀ 2.40-2.85, ♂ 2.40-2.70; width ♀ 2.00-2.35, ♂ 1.90-2.15. Abdomen length ♀ 2.30-4.90, ♂ 2.05-2.45; width ♀ 1.85-3.10, ♂ 1.45-1.65.

Holotype ♂, and allotype ♀; Sapporo, Hokkaido, 3. VI. 1974 (M. SUWA).

Paratypes: Hokkaido- 16♀, 1♂, Momoiwa, Rebun Is., 17. VII. 1971 (H. TANAKA); 16♀, Kobuka, Rebun Is., 18. VII. 1971 (H. TANAKA); 8♀, Himenuma, Rishiri Is., 27. VII. 1971 (H. TANAKA); 13♀, 11♂, Tokumitsu, 29. V. 1978 (M. SUWA); 9♀, 13♂, Shotonbetsu, 30. V. 1978 (M. SUWA); 19♀, 3♂, Kamiotoineppu, 10-14. VII. 1972 (M. SUWA); 12♀, 8♂, Ebetsu, 25. V. 1977 (M. SUWA); 12♀, same locality, 22. VII. 1980 (M. SUWA); 15♀, same locality, 11. VII. 1981 (M. SUWA); 5♀, Okushimokawa, 22. VII. 1977 (M. SUWA); 12♀, 13♂, Chitou, 30. V. 1980 (M. SUWA); 4♀, 1♂, Teuri Is., 18. VII. 1979 (Y. WATANUKI); 3♀, same locality, 2. VII. 1980 (Y. WATANUKI); 5♀, Antaroma, 8. VIII. 1980 (M. SUWA); 8♀, Inou, 9. VIII. 1980 (M. SUWA); 3♀, 3♂, Yamabe, 29-30. VI. 1979 (M. SUWA); 7♀, Koshunai, 15. VII. 1975 (F. KOMAI); 4♀, 16♂, Ishikarikanazawa, 15. V. 1978

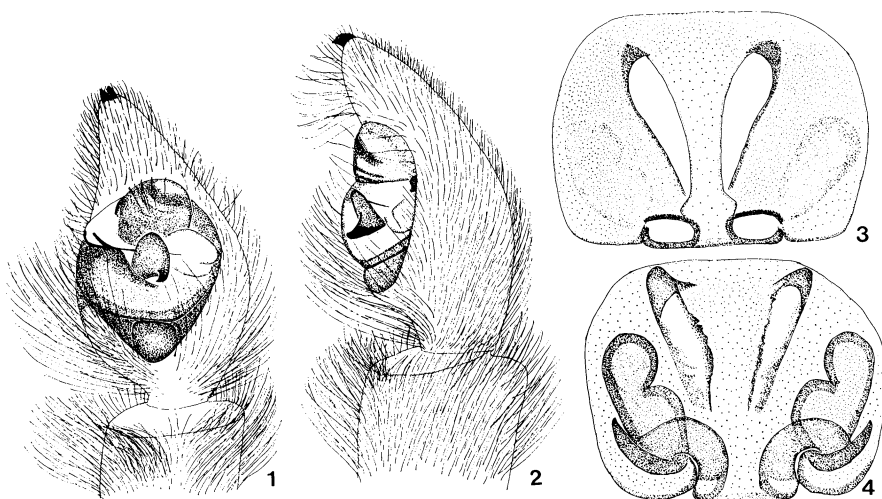
(M. SUWA); 1♀, Tengu-yama, Otaru, 30. V. 1975 (F. KOMAI); 2♀, 4♂, Sapporo, 3. VI. 1974 (M. SUWA); 10♀, same locality, 21. VIII. 1974 (M. SUWA); 7♀, 15♂, same locality, 11-12. V. 1975 (M. SUWA); 1♂, same locality, 27. IV. 1975 (M. SUWA); 10♀, same locality, 3. VIII. 1979 (H. TANAKA); 2♀, same locality, 4. VIII. 1980 (M. SUWA); 1♀, 1♂, same locality, 21. VI. 1981 (T. ENDO); 19♀, Ginzan, 1. VIII. 1980 (M. SUWA); 24♀, Iwanai, 22. VII. 1981 (M. SUWA); 1♀, 7♂, Shiribetsu, 4-8. VI. 1980 (N. YOSHIDA); 1♀, 13♂, Yoteizan, 5-8. VI. 1980 (N. YOSHIDA); 2♀, 2♂, Soubetsu, 22. V. 1980 (M. SUWA); 1♀, 1♂, Yutoku, 5. VI. 1980 (M. SUWA); 52♀, 6♂, Chihase, 22-23. VII. 1981 (M. SUWA); 13♀, 10♂, Toyoura, 21. V. 1980 (M. SUWA); 21♀, Warabitai, 1. VIII. 1980 (M. SUWA); 8♀, 9♂, Kunnui, 18. VI. 1981 (M. SUWA); 21♀, 8♂, Setana, 20. VI. 1981 (M. SUWA); 21♀, 1♂, Washinosu, 31. VII. 1980 (M. SUWA); 1♀, Ounuma-koyen, 11. VII. 1973 (H. TANAKA); 2♀, 3♂, same locality, 11. V. 1977 (M. SUWA); 25♀, same locality, 25. VIII. 1980 (M. SUWA); 13♀, Moheji, 30. VII. 1980 (M. SUWA); 20♀, Nakasuda, 30. VII. 1980 (M. SUWA); 4♂, Outome, 27. IV. 1982 (M. SUWA); 2♀, 17♂, Oyobe, 30. IV. 1980 (M. SUWA); Honshu- 27♀, 2♂, Kayanochaya, Hakkodasan, Aomori Pref., 11. VII. 1981 (M. SUWA); 22♀, 3♂, Sugayu, Hakkoda, Aomori Pref., 29. VII. 1981 (M. SUWA).

Distribution: Japan (Hokkaido, and Honshu).

Biological notes: This species lives in forests and the neighbouring areas. Females are found from late April to August, and males from late April to July. Formation of egg sacs is found from June or late May to August. The number of eggs varies from 15 to 40 in one egg sac.

Courtship behavior: The male holds a relatively low body posture (Rl or Rm) for 20-30 seconds period while facing the female. After holding the posture, he alternately and rapidly swings up his palpi several times, lifts his cephalothorax, and then approaches her swinging up both palpi (Ap, 1-3 seconds). He holds the relative low body posture toward her again and then repeats the series of behavioral pattern (SUWA, 1980).

Remarks: This species bears a resemblance to *Pardosa laura* KARSCH, *P. agraria* TANAKA, *P. diversa* TANAKA, *P. yamanoi* n. sp., and *P. laevitarsis* n. sp. in the shape of female epigynum and male palp. The discriminating points of them are given at the end of this paper. This species is the Form III named by SUWA (1984).



Figs. 1-4. *Pardosa hokkaido* n. sp. 1. Male palp (ventral view). 2. Male palp (retrolateral view). 3. Female epigynum (ventral view). 4. Female genitalia (dorsal view).

***Pardosa yamanoi* n. sp.**

(Japanese name: Tejiro-harige-komorigumo)

Male (Holotype)

Measurements (mm). Total length 4.45. Carapace length 2.40, width 1.70. Abdomen length 2.05, width 1.30.

Leg	Femur	Patella & Tibia	Metatarsus	Tarsus	Total
I	1.75	2.25	1.40	1.05	6.45
II	1.75	2.10	1.45	1.00	6.30
III	1.65	1.95	1.55	1.00	6.15
IV	2.25	2.75	2.65	1.40	9.05
Palp	0.85	0.95	—	0.80	2.60

Carapace blackish brown, with a yellowish brown median band, which is widened in front, and have a narrow line of white pubescence. AME larger than ALE; AME separated from each other by about the diameter of ALE, and from ALE by half the diameter ALE; anterior eye row procurved. Clypeus light yellow, larger than the diameter of AME. Chelicerae yellowish brown; chelicera with three teeth on retromargin. Maxillae whitish yellow. Labium grey. Sternum blackish brown, with a narrow yellowish brown median band. Abdomen reddish

brown, with some black transverse bars, and a narrow line of white hairs on median part; a median mark distinct; both sides reddish brown, with black markings and many white pubescence; venter light yellowish brown, with many white pubescence. Legs yellowish brown, except for whitish yellow ventral coxae III and IV; femora I-IV with annulations; white pubescence on all segments of legs I. Palpi blackish brown, with white pubescence on dorsum of femora and basal patellae; tarsal organs (Figs. 5-6) with a median apophysis; tarsus with two claws.

Allotype

Measurements (mm). Total length 6.05. Carapace length 2.50, width 1.95. Abdomen length 3.55, width 2.40.

Leg	Femur	Patella & Tibia	Metatarsus	Tarsus	Total
I	1.80	2.30	1.40	1.05	6.55
II	1.70	2.10	1.35	1.00	6.15
III	1.70	1.90	1.60	0.95	6.15
IV	2.40	3.00	2.75	1.35	9.50
Palp	0.85	1.00	—	0.85	2.70

Similar to the male holotype, but different in the following characteristics: Carapace reddish brown. Clypeus yellowish brown. Sternum dark brown, with a narrow light yellow line on median part. Abdomen median mark indistinct; both sides whitish yellow, with black markings. Legs and palpi yellowish brown, except for whitish yellow ventral coxae of all legs; legs I without white pubescence; palpal tarsus with a single claw. Epigynum (Fig. 7) with a anchor-shaped septum; spermathecae not exceeding anterior edge of genital openings (Fig. 8).

Variation: Total length ♀ 4.85-6.30, ♂ 4.25-4.95. Carapace length ♀ 2.50-2.65, ♂ 2.35-2.60; width ♀ 1.95-2.00, ♂ 1.70-1.90. Abdomen length ♀ 2.30-3.65, ♂ 1.90-2.35; width ♀ 1.50-2.60, ♂ 1.30-1.40.

Holotype ♂, and allotype ♀; Nissei-cho, Kakuijima, Waki-gun, Okayama Prefecture, Japan, 15. V. 1983 (T. YAMANO).

Paratypes: 1♀, 1♂, Tenhaku, Nagoya-city, Aichi Pref., 3. V. 1978 (H. NAGAI); 6♀, 5♂, same data as holotype; 2♂, Ashibe, Iki Is., Nagasaki Pref., 10. IV. 1978 (M. SUWA); 4♀, same locality, 29. VIII. 1984 (M. SUWA).

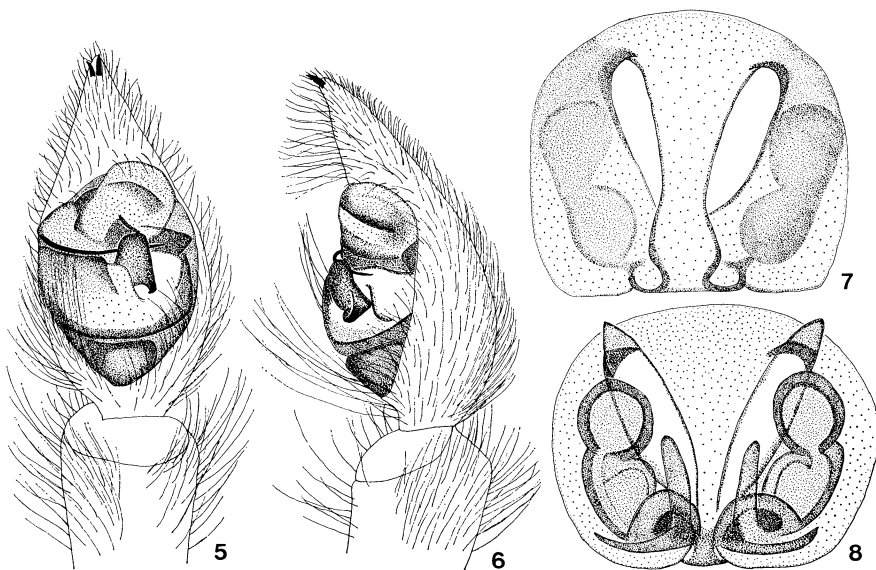
Distribution: Japan (Honshu, and Kyushu).

Biological notes: This species lives in damp areas among grasses in fields.

Mature specimens are found from April to August. An egg sac contains about 30 eggs.

Courtship behavior: The male holds a relatively low body posture and faces the female. Immediately after he faces her, he simultaneously and continuously swings up both hook-shaped palpi (Ps), while holding the posture. After he repeats the palpal motion for about 30 seconds period, he alternately pushes down the palpi (Bp, for 1-2 seconds) and advances a few steps without conspicuously lowering the body. Then he approaches the female using only his body without moving the legs, and then retreats from her using only the body and not moving the legs. He continues the hesitating, jaggy locomotion (Lj) for about 10 seconds, rests holding a relatively low body posture and then simultaneously swings up the palpi again while holding the posture. Then he copulates after the repetition of the series of behavioral pattern (SUWA, 1984).

Remarks: This species resembles *P. laura* KARSCH, *P. agraria* TANAKA, *P. diversa* TANAKA, *P. hokkaido* n. sp., and *P. laevitarsis* n. sp. The discriminating characters are noted at the end of this paper. This species corresponds to the Form Iki named by SUWA (1984).



Figs. 5-8. *Pardosa yamanoi* n. sp. 5. Male palp (ventral view). 6. Male palp (retrolateral view). 7. Female epigynum (ventral view). 8. Female genitalia (dorsal view).

***Pardosa laevitarsis* n. sp.**

(Japanese name: Tatesuji-harige-komorigumo)

Male (Holotype)

Measurements (mm). Total length 4.20. Carapace length 2.25, width 1.80. Abdomen length 1.95, width 1.25.

Leg	Femur	Patella & Tibia	Metatarsus	Tarsus	Total
I	1.80	2.25	1.60	1.00	6.65
II	1.65	2.15	1.55	0.95	6.30
III	1.75	2.05	1.75	0.95	6.50
IV	2.25	2.85	2.90	1.40	9.40
Palp	0.80	0.90	—	0.75	2.45

Carapace blackish brown, with a yellowish brown median band, which is widened in front. AME larger than ALE; AME separated from each other by about the diameter of AME, and from ALE by length being smaller than half the diameter of ALE; anterior eye row procurved. Clypeus light yellow, larger than the diameter of AME. Chelicerae blackish brown; chelicera with three teeth on retromargin. Maxillae, labium and sternum blackish brown, except for whitish yellow apex of labium and median part of sternum. Abdomen black, with a light yellow median line and many spots; a median mark indistinct; lateral and ventral sides light yellow, with many black markings and spots, and a narrow black line on the center of venter. Legs yellowish brown, except for black coxae and base of femur I and II. Palpi uniformly blackish brown, with blackish brown pubescence; tarsal organs (Figs. 9-10) with a median apophysis; tarsus with two claws.

Allotype

Measurements (mm). Total length 5.55. Carapace length 2.55, width 1.95. Abdomen length 3.00, width 2.10.

Leg	Femur	Patella & Tibia	Metatarsus	Tarsus	Total
I	2.00	2.50	1.40	1.00	6.90
II	1.90	2.35	1.40	1.00	6.65
III	1.85	2.25	1.65	0.90	6.65
IV	2.40	3.15	2.90	1.25	9.70
Palp	0.90	1.05	—	0.80	2.75

Similar to the male holotype, but different in the following characteristics:



Chelicera reddish brown. Maxillae yellowish brown. Labium and sternum blackish brown. Abdomen with a distinct median mark. Legs with annulations on femora I-IV, and on tibiae III-IV. Palpi yellowish brown, with annulations on femur and tibiae; palpal tarsus with one claw. Epigynum (Fig. 11) with a pair of slender genital openings; spermathecae (Fig. 12) not exceeding anterior edge of genital openings.

Variation: Total length ♀ 4.55-6.80, ♂ 4.15-4.80. Carapace length ♀ 2.50-3.00, ♂ 2.25-2.60; width ♀ 1.85-2.35, ♂ 1.65-2.00. Abdomen length ♀ 2.05-3.80, ♂ 1.90-2.25, width ♀ 1.50-2.65, ♂ 1.20-1.45.

Holotype ♂, and allotype ♀; Anbo, Yakushima Is., Kagoshima Prefecture, 18. V. 1973 (H. TANAKA).

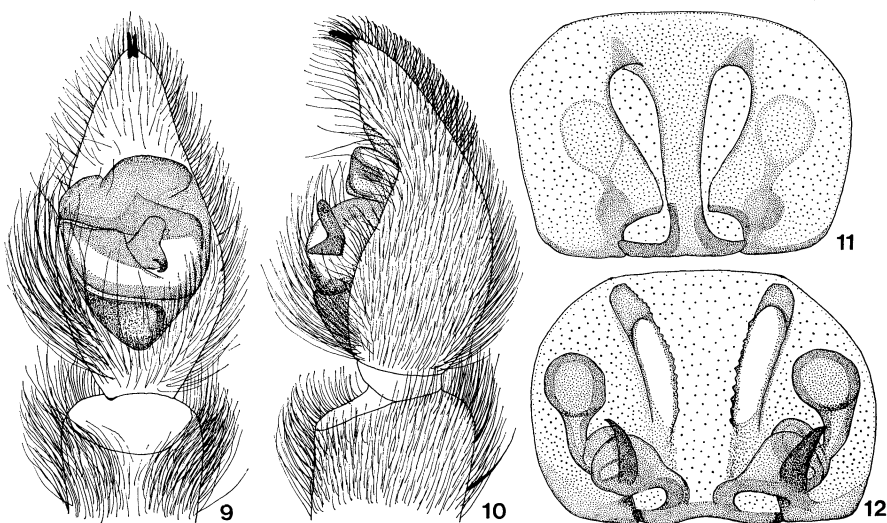
Paratypes: 14♀, 1♂, same data as holotype.

Other specimens examined: Nansei Isls.- 4♀, 2♂, Koniya, Amami-oshima Is., Kagoshima Pref., 29. III. 1969 (H. TANAKA); 1♂, Sumiyou, Amami-oshima Is., Kagoshima Pref., 7. IV. 1976 (E. NISHIDA); 38♀, 3♂, same locality, 6. IV. 1979 (M. SUWA); 8♀, 8♂, Ukenson, Amami-oshima Is., Kagoshima Pref., 1. IV. 1978 (H. YOSHIDA); 30♀, 20♂, Tathugou-cho, Amami-oshima Is., Kagoshima Pref., 7. IV. 1979 (M. SUWA); 10♀, 2♂, Kasari-cho, Amami-oshima Is., Kagoshima Pref., 17. V. 1981 (T. FUJISAWA); 10♀, 2♂, Todoroki, Tokunoshima Is., Kagoshima Pref., 17. V. 1981 (T. FUJISAWA); 1♀, Yona, Okinawa Is., Okinawa Pref., 15. IX. 1978 (T. GOTO); 79♀, 13♂, same locality, 2. V. 1981 (T. FUJISAWA); 3♀, Hentona, Okinawa Is., Okinawa Pref., 1976 (H. YOSHIDA); 2♀, Yasunami, Okinawa Is., Okinawa Pref., 4. IV. 1982 (E. NISHIDA); 2♀, Iyudake, Okinawa Is., Okinawa Pref., 27. III. 1980 (K. YASUDA); 7♀, 1♂, Touson, Okinawa Is., Okinawa Pref., 4. IV. 1982 (E. NISHIDA); 1♀, Genka, Okinawa Is., Okinawa Pref., 27. III. 1980 (K. YASUDA); 8♀, 5♂, Nago, Okinawa Is., Okinawa Pref., 3. IV. 1982 (E. NISHIDA); 2♀, Sueyoshi, Okinawa Is., Okinawa Pref., 4. IV. 1982 (K. YASUDA).

Distribution: Japan (Nansei Isls.)

Biological notes: This species inhabits a meadow near seashores and open lands of mountains. Females are found from March to September, and males from March to May. Formation of egg sacs is found from May to July. The number of eggs is about 35 in one egg sac.

Courtship behavior: The male holds a relatively low body posture (Rl or Rm) for several tens seconds periods while facing the female. Next, he holds up the hook-shaped palpi slightly, lowers them, lifts the body and then walks



Figs. 9-12. *Pardosa laevitarsis* n. sp. 9. Male palp (ventral view). 10. Male palp (retro-lateral view). 11. Female epigynum (ventral view). 12. Female genitalia (dorsal view).

convexly a few steps (resembling the jumping of a frog, but the spider's legs are in contact with the substrate). After he repeats the convex locomotion (Lc) for a few seconds, he again faces her in the low body posture. The series of behavioral patterns is repeated toward her (SUWA, 1984).

Remarks: This species resembles *P. laura* KARSCH, *P. agraria* TANAKA, *P. diversa* TANAKA, *P. hokkaido* n. sp., and *P. yamanoi* n. sp. The discriminating characters are noted at the end of this paper. This species is the Form Nansei named by SUWA (1984).

### The morphological and ethological differences of six species contained *Pardosa laura* complex

#### 1. Morphological difference

Characteristics	<i>laura</i>	<i>agraria</i>	<i>laevitarsis</i>	<i>diversa</i>	<i>hokkaido</i>	<i>yamanoi</i>
white pubescence on femur and patella of male palp	present	absent	absent	present	present	present
white pubescence of male leg I	absent	absent	absent	absent	absent	present
color of basal half on male femora I-II	yellowish brown	reddish brown	black	black	yellowish brown	yellowish brown
color of apical half on male metatarsus I	dark brown	reddish brown	yellowish brown	yellowish brown	yellowish brown	yellowish brown

## 2. Ethological difference

Courtship behavior	<i>laura</i>	<i>agraria</i>	<i>laevitarsis</i>	<i>diversa</i>	<i>hokkaido</i>	<i>yamanoi</i>
posture	Hh	Pp	Rl	Pa	Rl, Rm	Ps
motion (movement preceding locomotion)	Bp	—	—	Pv	—	Bp
(locomotion)	Al	U	Lc	Lr	Ap	Lj

Rl: Low body posture; Rm: Middle body posture; Hh: High body posture with legs I forming a M-shape; Pp: Posture with legs I held up; Pa: Posture while alternately swinging up palpi; Ps: Posture while simultaneously swinging up palpi; Bp: Movement in which palpi are alternately pushed down and body is lowered; Pv: Movement in which palpi are simultaneously pushed down and then violently vibrated; Al: Locomotion while moving palpi in all directions; U: Undulatory locomotion; Lc: Convex-shaped locomotion; Lr: Restless locomotion; Ap: Locomotion while swinging up palpi; Lj: Hesitating, jaggy locomotion. See SUWA (1984) for detailed explanation of abbreviations of courtship behavior.

## 摘 要

田中穂積 (金光第一高等学校, 〒569 高槻市東上牧), 諏訪将良 (北海道大学農学部応用動物学教室, 〒060 札幌市北区): ハリゲコモリグモ群の3新種とそれらの形態的および行動的特徴について。

*Pardosa laura* (ハリゲコモリグモ) に近似の3新種を形態および雄の求愛行動の面から記載した。形態的には、これら3種の雌雄の生殖器の構造には、ほとんど違いが見られないが、雄の触肢の白毛の状態において明瞭な違いが見られた。それに合わせて、雄の求愛行動の様式においても明らかに違いが見られた。3新種は以下のとおりである。

1. *Pardosa hokkaido* n. sp. (キタハリゲコモリグモ)
2. *P. yamanoi* n. sp. (テジロハリゲコモリグモ)
3. *P. laevitarsis* n. sp. (タテスジハリゲコモリグモ)

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- , 1984. Courtship behavior of 3 new forms in the wolf spider *Pardosa laura* complex. *J. Ethology*, 2: 99-107.

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